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The Maryland Fruit Grower

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SOILS AND ROOTS

It is a well-known necessity that the roots or our food-producing plants must be located in the soil. This soil will influence the growth and fruitfulness of the plants according to its content of fertility and moisture but depending also on the weather conditions above the soil. The plants or their products are influenced by the food supply of the plants, and there are many examples showing that the consumer of these plant products, whether man or animal, is in turn affected by the plant's nutrition. Lack of certain soil mineral elements such as iodine, in the Great Lakes region has caused high prevalence of goitre in that area. Dr. Firman E. Bear, of New Jersey Experiment Station, has made the following observations:

"Badly stunted livestock with small bones and stiff joints in low phosphorous soil areas: animals suffering from anemia in sections where cobalt is deficient in the soil: children and livestock both showing a lack of iron, copper, and manganese in their diet in some of the marginal-land areas of Florida; people more subject to tuberculosis in regions of acid soils than those living in high-lime areas of Finland.

"Likewise many examples of greater health and stamina are due to the quality of the soil. The earliest civilizations reached their highest levels and greatest permanence on the unleached soils of semi-arid areas (high in minerals). Limestone valleys, the world over, are favored for livestock production. The Bluegrass region of Kentucky with a soil high in phosphorous conent and other minerals is famed for its fine horses.

"The inhabitants of some localities in Texas are seldom troubled with decaying teeth because of natural mineral deposits in the soil. Notably fine physical specimens of mankind are found in the highly mineralized Great Plains area of this country.

"This highly important subject of adding more and more of the important elements (major and minor) to fertilizer mixtures that are used on the land is now being carefully explored. Consumers of food crops are interested in food crops that have been liberally fed with essential elements as well as with higher acre yields. In the eastern and southern part of the United States,

the rainfall is heavier and the soils in general have been so leached out that few elements remain. This means that a greater number of elements, as well as larger amounts of these, must be added to these rain-washed soils. Along the Atlantic Seaboard we find it necessary to add magnesium, manganse, boron, copper, and zinc, as well as the more common fertilizer elements, nitrogen, phosphorous, potassium, calcium and sulphur."

Every farmer is interested in making his soils highly receptive to the very best root development. California Circular 354, "Fertilizers and Cover Crops for California Deciduous Orchards" ("deciduous" simply means that the trees are those that shed their leaves), contains some very simple, yet interesting information regarding tree roots. The Circular states in part: "The mineral elements necessary for the normal nutrition of the tree are absorbed through root surfaces close to the growing tips of the roots. New roots may grow through a particular bit of soil, then die, and be replaced by new roots once or several times each year. During growth they absorb water and minerals. A mature tree will have developed a system of permanent roots extending throughout the available soil mass, together with innumerable temporary, small feeder roots.

"Whether or not the roots can absorb enough for the normal needs of the tree will depend upon soil fertility, depth, texture, moisture, and temperature; drainage and aeration; the species of the tree and the rootstock on which it is grown. Root branching may be unsatisfactory in either very coarse or very heavy soils, resulting in inefficient extraction of nutrients from a given volume of soil.

"Roots will not grow in dry soil nor with most species-saturated soils. Such conditions reduce the active root surface and probably the efficiency per unit of root surface, thus limiting the nutrient absorption. As has been demonstrated this absorption depends on soil temperature. The critical temperatures vary with species. For trees, the lower limit is probably near 45° F.; the maximum rate of activity near 70° F. Above 90° F. the activity is slight, and at slightly higher temperatures death of the roots will occur. In order to grow and function, tree roots need oxygen. Saturated or tight soil, through which the air can move only slowly, will not provide good environment. Different species of trees have different habits of root growth, some branching profusely, some very sparsely under the same conditions. Likewise, different roots have different abilities to extract nutrients from a given soil. It has been found, for example, that the same variety of apple growing on two selections of rootstocks on a potassium-deficient soil will show deficiency symptoms on one of these stocks and not on the other.

"In order that any added fertilizers may be absorbed, they must be brought into areas where the roots can come in contact with them. The depth to which they must penetrate will depend on conditions in the orchard. If there is sod, for example, the roots may grow to within an inch of the surface, whereas in some clean-cultivated orchards, where the soil temperature may be high, there may be but few roots in the top foot. In the latter case, the fertilizer must must be placed in the root zone mechanically in order to be absorbed by the tree.

"Not all fertilizers, even though soluble, will move downward with

water. Most soils have the ability to fix some of the common fertilizers. Potassium (potash, or K) is fixed—that is, taken out of solution and held—by most California soils. Even on sandy soils whose fixing power is less than that of the heavy soils, large surface applications are necessary for penetration into the root zone. Phosphate (P) also may be retained in large amounts by the surface soil. Some of the nitrogenous fertilizers, including all ammonia compounds, are fixed temporarily, but in the soil are changed by bacteria to nitrate, a form in which the nitrogen is free to move.

"The ready movement of nitrate is important, not only for transfer to the root zone, but also for washing through the root zone and being lost in the drainage water. The loss of nutrients may be serious in light soils subjected to heavy rainfall or excessive irrigation.

"Loss may also occur in soil that remains saturated for a considerable period, a condition suitable for the destruction of nitrogen compounds. This so-called denitrification process results in release of gaseous nitrogen to the atmosphere."

In the U. S. Department Daily Summary, under the heading "Roots Mine the Soils," there is more discussion of root functions, as follows: "Plants that root deep—including trees and some grasses—are important agents in enriching the surface soil. The deep-ranging roots draw from the deeper layers of the soil various plant nutrients, particularly the minerals. When the plant dies and decays these are returned to the soil, but are concentrated in the upper layers where shallow-rooting plants can draw on them. There are wide differences in the quantity of organic matter that can be returned to the soil under various conditions. It is estimated that natural soils, produce annually something less than a ton to the acre of dry organic matter in semi-arid grassland and up to more than 50 tons in the tropical rain forest. In the desert the production would be small, but not insignificant. Native vegetation on prairies soils may range from 1½ to 3 tons, and in temperate forest soils 2 to 4 tons of dry organic matter to the acre. The organic materials in plants are returned to the soil, furnishing food for other plants. Through this process, deep-rooted plants feed on the whole soil to a considerable depth and concentrate the organic matter and nutrient elements in the surface layers. Even when leaching is severe, plants that feed heavily on calcium and other mineral elements deep in the soil may keep the upper levels of soils supplied, but plants feeding lightly would not."

In some of the Cumberland-Shenandoah fruit soils, we have found a shallow soil condition with low moisture-holding capacity. Mulching has been widely discussed but a review of the effects of mulching should be of interest in connection with the discussion of root functions as given above. Soil Science, March 1945, gives a summary of a paper, "Effect of Mulches on Soil Properties" by Stephenson and Shuster of Oregon Experiment Station: "Moisture conservation, nutrient supply, and soil structure were compared on six treeless plots under different treatments—uncultivated sod; scraped and kept bare of growth; tillage mulch; spaded rough; straw mulch; and trash mulch—and on an adjacent orchard in sod.

"The straw mulch saved moisture equivalent to 2 or 3 inches of rainfall in dry weather. The moisture saving was principally in the upper 2 feet of soil. The trash mulch had a lesser moisture-saving effect.

"Nitrates were as high under straw mulch after it had been established for 3 years as under clean cultivation. The soil that was cultivated or mulched with straw was generally higher in nitrates than the plot that was scraped to control vegetation, probably because the scraped plot became drier than the other plots.

"The straw mulch caused a marked increase in soluble potassium but little increase in calcium in the topsoil. Trash mulch increased the soluble potassium to a lesser extent than did the straw.

"Straw and trash mulches increased the organic matter content of the topsoil.

"Both straw and trash caused an increase in the water-stable aggregates. The increase in the larger aggregates was most noticeable."

Studying the influence of soil management on apple tree roots, C. E. Baker, of Purdue Agricultural Experiment Station, reports in part: "Twenty-one year old Grimes trees in cultivation, straw-manure mulch, and bluegrass sod were compared. All of the trees in sod received liberal amounts of sulphate of ammonia each spring and half of the trees in the other two treatments received similar applications.

"In these studies, there was found no basis for concern regarding the effect of mulching on root development. Mulched trees, on the average, had as many roots at lower levels as trees in the other treatments, in addition to the roots near the surface and within the mulch. The mulched trees are vigorous and highly productive.

"As the trees growing in bluegrass sod have received liberal amounts of a nitrogen fertilizer annually, they have made excellent growth and are the largest trees in any of the three treatments, in contrast to the trees in sod without nitrogen. They also are very productive. The roots were found to be well distributed and similar to the other treatments in size and depth.

"The cultivated trees are the smallest of those in any of the three treatments. They are making little annual growth and bear very little fruit. The root systems of cultivated trees receiving no nitrogen fertilizer were smaller than those of trees in sod or mulch, but the roots of cultivated trees receiving annual applications of nitrogen compared very favorably with the roots of trees in the other treatments.

"It is true that the small, fibrous roots that appear in such large numbers in and beneath a mulch are killed, or at least rendered temporarily inactive, in extremely dry periods. This seems to have no detrimental effect upon the tree, however, as the deeper roots continue to function and are able to supply water to the tree as long as moisture is available to them. When favorable moisture conditions again prevail on the surface, the fibrous roots, for the most part become active again. New masses of tiny rootlets are produced and these continue to function as long as conditions remain favorable.

"Special attention was given to the occurrence of these fibrous roots in the upper six inches of soil under all three treatments. It was found that even though none of these roots appeared above the surface on trees in sod or cultivation, they were present in the upper six inches of soil in abundance in all treatments. Some of the trees in sod, and even some of the trees in cultivation, had in the upper six inches a greater volume and weight of roots less than one-quarter of an inch in diameter than did some of the mulched

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trees. In the case of the trees in cultivation, a portion of the area beneath the tree, which no longer is cultivated was, of course, included. The surface soil of this area is especially abundant in very small roots, probably resulting from root pruning that took place during cultivation when the trees were smaller and the cultivating tools operated more closely to the trees. With trees in sod, it was not at all unusual to find masses of fibrous tree roots intermingled with the roots of the grass about three inches below the surface.

"It is probable that during extremely dry periods of considerable duration, when the moisture in the upper six inches of soil was well below the wilting coefficient that these roots also are rendered inactive or may actually die from lack of moisture.

"It should also be emphasized that it is on shallow soils, where root growth is restricted, that mulching is likely to pay the biggest dividends. On light or sandy soils, where roots can penetrate to great depths, and where rainfall also enters the soil easily, there is less need of mulching. The response to mulching would not be so great under these more favorable conditions. In the case of a shallow clay soil where it is necessary to conserve moisture for use during dry periods, mulching performs an important function. Such a soil is likely to be one into which rainfall penetrates slowly or inefficiently. A good heavy mulch checks the run-off of surface water and increases the amount that percolates into the soil, thus building up the soil supply. Then by checking evaporation, it prevents the loss of much of this soil moisture and holds it in the root zone for the future use of the tree.

"Mulches also improve the physical characteristics of heavy soils by increasing the organic matter in the surface area, causing it to become more open in structure so that water enters and percolates into it more readily. This physical improvement of the soil also makes it a better medium for root growth and development.

"An important function of mulching on sandy soils is in connection with transplanting of young trees. Soils of light or sandy structure often dry out rapidly to a considerable depth and sometimes young trees have difficulty in establishing themselves. An adequate mulch aids in conserving the moisture in the surface area, permitting the tree to develop roots that grow to lower depths where moisture conditions are more dependable. Here again there seems to be no tendency for apple trees to develop shallow roots at the expense of deeper ones."

"After all, we only have one life to live."

"Well, with prices and taxes going up, it's lucky that one is the limit."

THE WINTER MEETING

Remember January 3 and 4, 1946. The Maryland State Horticultural Society will hold its Forty-Eighth Annual Meeting on those dates, at Hotel Alexander, Hagerstown. Tentative program includes discussions of live topics and growers' problems.

"Mother, shall I run out and post this letter?"

"No, certainly not, child. It's raining torrents and not fit for a dog to be out. Let your father go."

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MARYLAND STATE HORTICULTURAL SOCIFTY MEETINGS

Hotel Alexander - Hagerstown, Maryland

January 3 & 4, 1946

Thursday Morning, January 3

10:30 - Where Do We Stand on Domestic Rates for Electricity?
A Comparison of Power Rates in Orchard Cold Storage Operation.
A. W. Krewatch, College Park, Md.
Question Box (questions submitted by growers):
How many acres of peaches will a hive of bees pollinate?
What about nursery stock and future plantings?
Best commercial peach ripening about 10 days before Elberta? Best freezing varieties?
What about wax-oil sprays or other materials for delaying blossoming?
Why the variable results in using de-blossoming sprays?

11:00 - Are We Ready for Cooperative Efforts in By-products Manufacture?

1. Considerations in Establishing a Fruit By-products Plant. - L. E. Newcomer
2. How Cooperatives are Organized and Financed. - S. M. Thomson

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Thursday Afternoon, January 3

1:30 - Invocation

1:35 - President's Remarks
Report of Secretary-Treasurer
Appointment of Committees

1:50 - DDT - Uses, Benefits, and Limitations of This New Insecticide.
Discussion Leader - E. N. Cory
DDT in Codling Moth Control - W. S. Hough (Virginia)
Our Results with DDT in Experimental Work. - Edwin Gould (West Virginia)
DDT in Insect Control in Maryland. - C. Graham
A Grower's Experience with DDT in Combatting Codling Moth. - H. W. Miller, Jr.
A Grower's Experience in Peach Borer Control with DDT. - S. M. Fulton
Phenothiazine or DDT? - Harvey Raffensperger

Question Box (questions submitted by growers):
Can tarnished plant bug and European red mite be controlled commercially?
Describe best control for peach tree borer and San Jose scale.
What's new in curculio control?
Are open flame traps effective in codling moth control? What about attractants?
Which is best for Oriental moth control - parasites or DDT?

6:30 - Annual Dinner

Friday Morning, January 4

9:30 - The Grower's Responsibility in Supporting the Various Service Organizations. - S. M. Fulton

9:45 - The Orchard Labor Outlook for 1946. What Can We Do About It?-P.E. Nystrom

10:15 - Aims of the Food Producers' Council. - P. C. Turner

10:45 - Reports of Committees

Question Box (questions submitted by growers):
How control peach brown rot? Bacterial spot?
Is 1-75 lime sulfur too weak to control apple scab?
Compare zinc hydrate with lime as a safener. Can more lead be used with zinc hydrate?
Why not use 4 pounds of lead in all early sprays instead of 3 pounds?

Friday Afternoon, January 4

1:30 - Question Box (questions submitted by growers):
Can growers burn brush at any time other than 4 P.M. to midnight?
Can honeysuckle and poison ivy be controlled practically?
Is our present spraying equipment soon to become obsolete?
Outline best soil treatment for peach orchards.

1:45 - Handling Orchard Soils and Cover Crops in Northern Maryland. - C.O. Dunbar

2:15 - Some Observations on the Present and Future of the Fruit Industry. - Truman Nold

Adjournment

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GIVE TREES A CHANCE

It is surprising how many trees, especially peach trees, have been "going out" from deep planting, during the past few years. In some cases trees set on hillsides were set deeply with the expectation that the later soil erosion would leave them set at about the right depth. In other cases, the trees were set then terraces were thrown up. In still other cases, the trees were set in deep furrows and the trouble began. Dead or dying trees were dug up and in many cases, the roots had actually tried to grow perpendicularly to get up out of the cold wet soil, to higher soil levels. Peach trees do not tend to throw out roots from the cion above the bud as apple trees will do, so they do not adapt themselves to poor soil conditions as do apple trees. A good rule to follow in setting peach trees is not to set the trees more than an inch or so above the bud-scar. Some peach trees have long root stocks with roots only at the bottom of the stock. In heavier soils it is not advisable to set such trees so that the bud-scar is covered. In fact, it may be better to allow the bud-scar to be several inches above ground. The grower must judge his soil and set the tree to a depth in accordance with soil and subsoil conditions. Peach roots do well in a soil supplied with sufficient moisture but they will not tolerate wet feet. If trees are to be set on terraces, make the terrace ahead of time and allow it to settle before trees are set. The terraces should be built in spring or summer for fall planting and in late summer or fall for spring planting.

MORE ABOUT SCAB CONTROL

It will be remembered that several years ago the question of spraying the orchard "floor" during the dormant season was discussed and it was decided that due to costs, it might be better to use the "floor" spray only in low sections of the orchard where early spring conditions made it impossible to get through such low spots. The spray used is Elgetol at one-half percent concentration. It is estimated that 95 per cent of the over-wintering spores may be killed by the spray, using about 400 gallons per acre, applied by a horizontal boom attached to the rear of the sprayer. The treatment is not always a sure control but depends upon the weather following application. In any case, the "floor" spray is a supplement to regular spring scab sprays, and does not replace such sprays.

HERE'S THOSE MICE AGAIN

Although mice were not very destructive last season, there is evidence that they are becoming active in the low-lying sections of orchards. Growers are warned to examine their orchards for evidence of mice. Look around trees for their "breather holes," and then look for burrows. Then kick out a part of the burrow and cover it with some dry grass. Next day see if the burrow has been repaired. If so, get ready with zinc phosphide bait applied to apple cubes and bait 3 or 4 burrows around the tree This is no easy or careless job, and should be done right or not at all. Some orchards have been found in Maryland where the infestation of mice is serious and the control seems almost a heart-breaking job.

Some girls go to college to pursue learning, and others go to learn pursuing.

Have You Read the Advertisements?

Give YOUR Trees The Benefit of PRATT'S DDT SPRAYS

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PRATT'S 25% DDT is the long looked for answer to codling moth control. Add 2 pints per 100 gallons to the regular cover sprays. Also effective against such serious pests as leaf roller and oriental peach moth.

W. P., N. Y., writes:
"In the Triangle orchard I used only two Pratt's DDT sprays,—First brood codling moth 2 quarts DDT and 3 lbs. arsenate of lead per 100 gallons. Second brood 2 quarts DDT with 3 quarts Pratt's Summer Spra-Cream per 100. From this block we picked 183 crates with exactly 12 crates of culls, which included drops from picking. There were no entrances and very few stings, although last year our codling moth injury was very bad. This reminded me of the old times when you picked and did no sorting."

Pratt's 25% DDT is DDT in its most versatile and valuable form. It is also diluted in 4 parts of water for treatment of barns, dairies, etc., for fly control.

D-X SPRAY contains more rotenone and pyrethrum than pre-War D-X—a most successful spray—in addition it contains 5% DDT. DDT—most valuable against certain pests—is not effective against red mite, pear psylla, curculio or heavy infestations of aphis. The rotenone and pyrethrum in D-X spray makes up for this deficiency without losing the value of DDT.

Use 1½ pints D-X Spray per 100 gallons added to the regular cover sprays for codling moth, leaf roller and pests for which DDT is recommended. It is especially valuable in areas where red mite and aphis are serious.

PRATT'S 50% Dry Wettable DDT is a handy form of DDT for uses where DDT is recommended. It may be diluted in the spray tank for the various formulations suggested by the Experiment Stations, or used as a dust with the proper carrier. Two pounds of Pratt's 50% Dry Wettable DDT in 100 gallons of water makes a 1% DDT spray. Packed in 50 pound containers. Ask your dealers for these Pratt's DDT products or write us.

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